

Fungicide and Nematicide Update

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Current Status of Fungicide Testing on Vegetable Crops

Over 60 experiments involving fungicide evaluations on vegetable crops were conducted during 1984 and reported in volume 40 of *Fungicide and Nematicide Tests*. Seventeen vegetable commodities were studied.

Fungicide groups. Such sterol-inhibiting fungicides as bitertanol (Baycor), propiconazol (Tilt), triadimefon (Bayleton), and triforine (Funginex) provided good control of asparagus rust (*Puccinia asparagi*), snap bean rust (*Uromyces appendiculatus*), and cucurbit powdery mildew (*Erysiphe cichoracearum*). Experimental compounds controlling these diseases included DPX H6573, KWG-0519, and RH-3866. Triadimefon provided the best control of asparagus rust, whereas bitertanol, propiconazol, and RH-3866 provided the best control of snap bean rust. All the sterol-inhibiting fungicides provided excellent control of cucurbit powdery mildew but poor control of other foliar cucurbit diseases, such as downy mildew (*Pseudoperonospora cubensis*) and anthracnose (*Colletotrichum lagenarium*). The sterol inhibitors were combined with other fungicides to control these cucurbit diseases.

The dicarboximide fungicides vinclozolin (Ronilan) and iprodione (Rovral) controlled white mold (*Sclerotinia sclerotiorum*) and gray mold (*Botrytis cinerea*) of snap beans and lettuce drop (*Sclerotinia minor*, *S. sclerotiorum*). Vinclozolin and iprodione provided comparable control of lettuce drop, but vinclozolin controlled snap bean white mold better. Iprodione provided good control of cabbage storage rot caused by *B. cinerea* and partial control of that caused by *Alternaria brassicicola*.

Phycomycete-specific fungicides included benalaxyl (Galben), cyprofuram (Vinicur), and metalaxyl (Ridomil). In an effort to prevent resistant strains of fungi to these products, several coformulations were tested: 6% benalaxyl plus 53% mancozeb (Galben M), 9% metalaxyl plus 72% chlorothalonil, 10% metalaxyl plus 48% mancozeb (Ridomil MZ 58), chlorothalonil plus oxadixyl (SDS 63049), and 15% cyprofuram plus 33% mancozeb (Vinicur MSC). These fungicides controlled downy mildew of broccoli (*Peronospora parasitica*) and cucumbers (*Pseudoperonospora cubensis*), damping-off (*Pythium aphanidermatum*) and cottony leak (*P. aphanidermatum*) of

cucumbers, *Phytophthora* blight (*P. capsici*) of peppers, and late blight (*Phytophthora infestans*) of potatoes. Of particular interest was that a single application of metalaxyl or cyprofuram to soil after seeding controlled broccoli downy mildew.

Bacterial leaf spots of peppers (*Xanthomonas vesicatoria*) and tomatoes (*Pseudomonas syringae* pv. *tomato*) have been difficult to control over the years, primarily because few effective materials have been available. In 1984, these diseases were controlled with copper hydroxide (Kocide) plus mancozeb, chlorothalonil plus copper oxychloride (DS-64220), streptomycin sulfate (Agri-mycin 17), oxytetracycline (Mycoshield), copper oxychloride sulfate (COCS), and the experimental compound AR 153845. Copper hydroxide plus mancozeb provided consistent control, and addition of an adjuvant to oxytetracycline improved results.

Varied schedules. Numerous fungicide application schedules were evaluated on potatoes and tomatoes. The two prevalent foliar pathogens of potatoes requiring control are *Alternaria solani* and *Phytophthora infestans*. Those for tomatoes include these two plus *Septoria lycopersici* and *Colletotrichum coccodes*.

Many schedules for potato and tomato tests involved low rates of a fungicide, e.g., chlorothalonil, early in the growing season, followed by progressively higher rates; these schedules resulted in satisfactory control. Other schedules involved a broad-spectrum fungicide, e.g., mancozeb, early in the season, followed by a phycomycete-specific fungicide combined with a broad-spectrum fungicide, e.g., metalaxyl plus mancozeb. Control of early blight on potatoes was better when metalaxyl plus mancozeb (Ridomil MZ) was substituted for mancozeb (Dithane M-45) in the middle of the growing season rather than early or late. Because of the systemic activity of the phycomycete-specific fungicides, a 14-day schedule was followed; both 7-day and 14-day schedules were evaluated in many trials, however. Control of foliar and tuber blight of potatoes with metalaxyl plus mancozeb (Ridomil MZ 58) was best with a 7-day schedule. Although foliar disease control decreased slightly, tuber blight control was still sufficient at 14 days.

Another common trend was application of tank mixes of fungicides at each spray date. Often, control of foliar diseases was best when tank mixes were used. Metalaxyl plus mancozeb (Ridomil MZ

58) tank-mixed with mancozeb (Dithane M-45) or with metiram (Polyram A) provided excellent control of late blight of potatoes, and fentin hydroxide (Duter, Triple Tin) tank-mixed with mancozeb (Dithane M-45) or with chlorothalonil (Bravo 500) gave excellent control of early blight.

One fungicide schedule was based on the disease forecasting system FAST (Forecasting *Alternaria solani* on Tomatoes). The experiment was conducted in seven fields in five counties in Pennsylvania. The FAST system was followed from transplanting until first appearance of ripe fruit, then a regular fungicide schedule was followed until the end of the season. Fungicides evaluated included chlorothalonil (Bravo 500), captafol (Difolatan), mancozeb (Dithane M-45), and maneb (Manex, Manzate). For all fungicides, control of early blight was as effective with the FAST system as with a regular schedule followed full season. The average number of fungicide applications with the FAST system was 4.9, compared with 7.4 with the regular schedule.

Fungicide application in irrigation water. Many diseases of vegetable crops are being controlled by applying fungicides in overhead irrigation systems. This technique appeared to be particularly effective against soilborne diseases and foliar diseases deep within the canopy. Southern blight (*Sclerotium rolfsii*) of carrots was controlled by applying etaconazole (Vanguard) through the irrigation system. A single application of metalaxyl (Ridomil) through the irrigation system at the first sign of disease resulted in outstanding control of buckeye rot (*Phytophthora* spp.) of tomato.

Seven applications of mancozeb (Dithane M-45), fentin hydroxide (Triple Tin), or captafol (Difolatan) through a center-pivot irrigation system controlled early blight and increased yield of potatoes. Other tests showed that *Xanthomonas vesicatoria*, *Alternaria solani*, *Septoria lycopersici*, and *Colletotrichum phomoides* of tomato were controlled by center-pivot irrigation applications of copper-containing fungicides plus mancozeb, metiram, or captafol.

Dr. Johnston is editor of the vegetable crops section of Fungicide and Nematicide Tests, David F. Ritchie, Editor, published annually by the New Fungicide and Nematicide Data Committee of The American Phytopathological Society. Copies of current and past volumes may be obtained from Richard E. Stuckey, Business Manager F & N Tests, Plant Pathology Department, University of Kentucky, Lexington 40546.

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